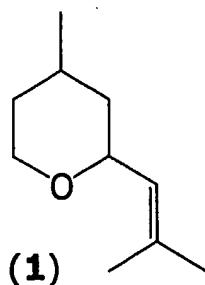


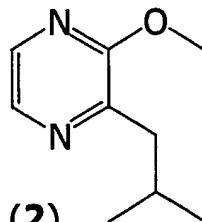
### FRAGRANCE COMPOSITION

The invention relates to new fragrance ingredients, their manufacture and use in fragrance compositions, particularly in fine perfumery and cosmetics compositions.

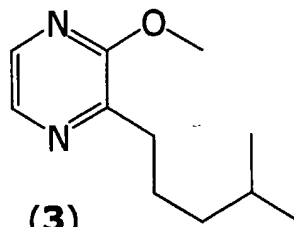
During their investigations of the low-boiling constituents of Bulgarian rose oil in 1959, C. F. Seidel and M. Stoll (*Helv. Chim. Acta* 1959, 42, 1830) discovered an important trace constituent of green-metallic odor reminiscent of geranium oil and carrot leaves. They termed this new odorant rose oxide and later attributed it the structure 1 (C.F. Seidel, D. Felix, A. Eschenmoser, K. Biemann, E. Palluy, M. Stoll, *Helv. Chim. Acta* 1961, 44, 598). Though in substance the very powerful, green-metallic odor of rose oxide is rather unpleasant, today it is extensively used in many fragrances to provide diffusivity, lift and naturalness, especially in the top note of perfumes.



(1)  
rose oxide



(2)  
Galbazine®



(3)

The methoxy pyrazines 2 and 3 represent another class of very powerful green odorants. 2 was first discovered by R. G. Buttery et al. in green bell pepper oil (R. G. Buttery, R. M. Seifert, R. E. Lundin, D. G. Guadagni, L. C. Ling, *Chem. Ind.* 1969, 490) and later also found in galbanum oil (A. F. Bramwell, J. W. K. Burrell, G. Riezebos, *Tetrahedron Lett.* 1969, 3215). It is reminiscent of pepperoni, galbanum oil and green peas, and has been introduced into perfumery successfully as Galbazine®. Isohexyl methoxy pyrazine (3) with its more pleasant green, vegetable and hyacinth odor is also frequently used in perfumery, though in very low concentration because of its exceptional strength. Yet, even in high dilutions, all

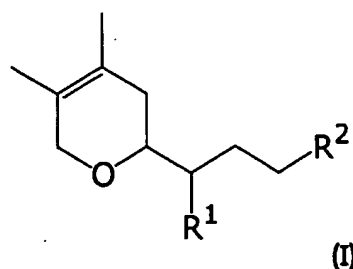
these pyrazines have harsh, unpleasant by-odors, which limit their use in perfumery.

Unfortunately, blending of the aforementioned materials has not led to any interesting odor tonalities without harsh, unpleasant or metallic-burnt aspects being noticeable.

Accordingly, there is a need to provide new ingredients to develop interesting odor tonalities that have proven inaccessible by simple blending of these known compounds.

Surprisingly, it has now been found that certain 3,6-dihydro-2H-pyrans possess the characteristic odor notes of methoxy pyrazines, but do not exhibit the harsh by-notes that prohibit the extensive use of these pyrazines in perfumery. Facets of rose oxides are also present in these compounds leading to overall interesting, novel odor tonalities.

Therefore, the invention provides in a first aspect a compound of the general formula (I),



wherein  $R^1 = \text{H}, \text{CH}_3, \text{ or } \text{CH}_2\text{CH}_3,$

and  $R^2 = \text{H}, \text{CH}_3, \text{CH}_2\text{CH}_3, \text{ or } \text{CH}_2\text{CH}_2\text{CH}_3,$  provided that when

$R^1$  is H,  $R^2$  is H.

The compounds of formula (I) may comprise more than one chiral centre and as such they may exist as a mixture of enantiomers and diastereomers, or they may be resolved as enantiomerically and diastereomerically pure forms. However, resolving stereoisomers adds to the complexity of manufacture and purification of these compounds and so it is preferred to use a compound of formula (I) as a mixture of its stereoisomers simply for economic reasons.

However, if it is desired to prepare pure stereoisomers, this may be achieved according to methodology known in the art.

Compounds of formula (I) may be prepared according to techniques known in the art using commercially-available starting materials, or materials that can be easily prepared from known starting materials. The compounds may be prepared according to a hetero-Diels-Alder reaction using 2,3-dimethyl-1,3-butadiene and an appropriately substituted aldehyde, for example butyraldehyde may be employed in the formation of compound (7) in Table 1. Reaction conditions for these Diels-Alder reactions are more fully described in the Examples set forth below. The skilled person will appreciate that other compounds of the present invention may be prepared using an appropriately substituted aldehyde.

In another aspect of the present invention there is provided the use of a compound of the general formula (I) or mixtures thereof as a fragrance ingredient wherein,

$R^1 = H, CH_3 \text{ or } CH_2CH_3$ , and

$R^2 = H, CH_3, CH_2CH_3 \text{ or } CH_2CH_2CH_3$ .

Compounds described hereinabove possess unique, character-donating aspects that makes them suitable for a broad range of possible applications in perfumery. Furthermore, because the compounds do not possess the harsh unpleasant by-notes of the pyrazines exemplified by (2) and (3) above, they may confer a fresh green touch to virtually all kinds of perfume compositions, in virtually all kinds of applications from fine fragrances to cosmetics and detergents, e.g. in shampoos, skin-care products or soaps. Depending on the dosage, the effects can extend from providing more naturalness and character to building up hyacinth or petigrain or other green accords. The use is neither limited to any type of perfume nor to any special olfactory directions, odorants or classes of substances. A few illustrative examples of classes of substances, which harmonise equally well are:

- ethereal oils and extracts, e.g. angelica oil, basilic oil, bergamot oil, carrot seed oil, citrus oils, coriander oil, galbanum oil, geranium oil, jasmin absolute, neroli oil, orris oil, petitgrain oil, rose oil, or violet leaf oil;

- alcohols, e.g. citronellol, cinnamic alcohol, dihydromyrcenol, Ebanol<sup>®</sup>, Florol<sup>®</sup>, geraniol, linalool, Mayol<sup>®</sup>, phenylethyl alcohol or terpeneol ;
- 5 - aldehydes and ketones, e.g. decanal, *alpha*-hexylcinnamaldehyd, hydroxy-citronellal, isoeugenol, Iso E Super<sup>®</sup>, Isoraldeine<sup>®</sup>, Hedione<sup>®</sup>, methylionone or vanillin;
- ether and acetals, e.g. Ambrox<sup>®</sup>, 2-(1-ethoxyethoxy)ethyl benzene, geranyl methyl ether, Magnolan<sup>®</sup>, 2-(1-propoxyethoxy)ethyl benzene, or rose oxide  
10 (1).
- esters and lactones, e.g. benzyl acetate, benzyl salicylate, coumarin,  $\gamma$ -decalactone, ethylene brassylate, Thibetolide<sup>®</sup>,  $\gamma$ -undecalactone.
- 15 - heterocycles, e.g. indol, Galbazine<sup>®</sup> (2) or 6-/8-isobutylchinoline.

Compounds of formula (I) that are particularly preferred for their fragrance properties are set forth in Table 1.

20

Table 1. Compounds of general formula (I) having R<sup>1</sup> and R<sup>2</sup> as indicated

Compound	R <sup>1</sup>	R <sup>2</sup>
4	H	Methyl
5	H	Ethyl
6	H	Propyl
7	H	H
8	Ethyl	H
9	Methyl	H
10	Methyl	Methyl

Having regard to compounds in Table 1, compound 4, compound 5 and compound 6 are known compounds, however, the olfactory properties of these compounds have not been previously disclosed.

Compounds according to the formula (I) may be employed in any of the  
5 fragrance compositions referred to above in widely varying amounts having regard to the other fragrance ingredients employed and depending on the fragrance accord that a perfumer is trying to achieve. Generally however, one may employ about 0.01 to 1.0% by weight in fine fragrances and about 0.01 to 10% by weight in other perfumed products.

10 In addition to their admixture with other fragrance ingredients, the compounds of formula (I) may be admixed with one or more excipients conventionally used in conjunction with fragrances in fragrance compositions, for example carrier materials, and other auxiliary agents commonly used in the art such as solvents, preservatives, colourants and the like. The invention therefore  
15 also provides

- a fragrance composition comprising at least one compound as hereinabove defined; and
- 20 - a method of conferring a desired fragrance on a fragrance composition, comprising the blending with known fragrance ingredients and/or excipients of at least one compound as hereinabove defined.

The invention is now illustrated with reference to the following non-  
25 limiting examples.

#### Examples

##### 4,5-Dimethyl-2-propyl-3,6-dihydro-2H-pyran (Compound 7):

30

2-Nitropropane (1.8 ml, 20 mmol) was added at 0 °C to a stirred suspension of aluminium trichloride (2.67 g, 20 mmol) in dichloromethane (50 ml). A solution of butanal (14.4 g, 200 mmol) in dichloromethane (30 ml) was added, followed by

dropwise addition of 2,3-dimethyl-1,3-butadiene (24.6 g, 300 mmol) at 0 °C. After stirring for 3h at this temperature, and for 1h at ambient temperature, the reaction mixture was poured into water (400 ml) and the product extracted with pentane (3x 300 ml). The combined organic extracts were dried, concentrated in vacuo, and purified by silica-gel FC (pentane/MTBE, 99:1) to provide the title compound 7 (3.55 g, 12%).

Odor: green, spicy, rose oxide, vegetable. – IR (neat):  $\nu$  = 1098  $\text{cm}^{-1}$  ( $\nu$  C–O–C), 1386 ( $\delta$  CH<sub>3</sub>), 1449 ( $\delta$  CH<sub>2</sub>). – <sup>1</sup>H-NMR (CDCl<sub>3</sub>):  $\delta$  = 0.93 (t,  $J$  = 7.0 Hz, 3H, 5'-H<sub>3</sub>), 1.34–1.57 (m, 4H, 1'-H<sub>2</sub>–2'-H<sub>2</sub>), 1.53 / 1.63 (2s, 6H, 4,5-Me), 1.80 (d,  $J$  = 16.5 Hz, 1H, 3-H<sub>b</sub>), 1.93 (br. t,  $J$  = 16.5 Hz, 1H, 3-H<sub>a</sub>), 3.47 (m, 1H, 2-H), 3.93 / 4.01 (2d,  $J$  = 15.5 Hz, 2H, 6-H<sub>2</sub>). – <sup>13</sup>C-NMR (CDCl<sub>3</sub>):  $\delta$  = 13.8 (q, 5-Me), 14.1 (q, C-3'), 18.3 (q, 4-Me), 18.6 (C-2'), 36.7 (t, C-3), 38.0 (t, C-1'), 69.8 (t, C-6), 73.9 (d, C-2), 123.5 / 124.3 (2s, C-4,-5). – MS (EI):  $m/z$  (%) = 41 (45) [C<sub>3</sub>H<sub>5</sub><sup>+</sup>], 55 (55) [C<sub>4</sub>H<sub>7</sub><sup>+</sup>], 67 (100) [C<sub>5</sub>H<sub>7</sub><sup>+</sup>], 82 (99) [C<sub>6</sub>H<sub>10</sub><sup>+</sup>], 111 (19) [M<sup>+</sup>–C<sub>3</sub>H<sub>7</sub>], 139 (21) [M<sup>+</sup>–CH<sub>3</sub>], 154 (67) [M<sup>+</sup>].

#### 2-(1-Ethylpropyl)-4,5-dimethyl-3,6-dihydro-2H-pyran (Compound 8):

2-Nitropropane (1.8 ml, 20 mmol) was added at –10 °C to a stirred suspension of aluminium trichloride (2.67 g, 20 mmol) in dichloromethane (80 ml). At this temperature, 2-ethylbutanal (20.0 g, 200 mmol) was added dropwise during 20 min, followed by 2,3-dimethyl-1,3-butadiene (24.6 g, 300 mmol) during 30 min. After further stirring at this temperature for 30 min, and for 1h at ambient temperature, the reaction mixture was poured into water (300 ml) and the product extracted with MTBE (3x 300 ml). The combined organic extracts were dried, concentrated in vacuo, and purified by silica-gel FC (pentane/MTBE, 100:1,  $R_f$  = 0.47) to provide the title compound 8 (5.53 g, 15%).

Odor: green, carrot leaves, rose oxide, metallic, green peas, galbanum. – IR (neat):  $\nu$  = 1099  $\text{cm}^{-1}$  ( $\nu$  C–O–C), 1384 ( $\delta$  CH<sub>3</sub>), 1461 ( $\delta$  CH<sub>2</sub>). – <sup>1</sup>H-NMR (CDCl<sub>3</sub>):  $\delta$  = 0.88 (t,  $J$  = 7.5 Hz, 6H, 3'-,2'''-H<sub>2</sub>), 1.53 / 1.64 (2s, 6H, 4,5-Me), 1.19–1.50 (m, 5H, 1'-H, 2'-,1'''-H<sub>2</sub>), 1.74 (br. d,  $J$  = 16.0 Hz, 1H, 3-H<sub>b</sub>), 2.03 (br. t,  $J$  = 16.0, 1H, 3-H<sub>a</sub>), 3.41 (m, 1H, 2-H),

3.93 / 3.99 (2d,  $J = 15.5$  Hz, 2H, 6-H<sub>2</sub>). – <sup>13</sup>C-NMR (CDCl<sub>3</sub>):  $\delta = 11.2 / 11.3$  (2q, C-3',-2''), 13.7 (q, 5-Me), 18.4 (q, 4-Me), 21.2 / 21.3 (2t, C-2',-1''), 33.5 (t, C-3), 45.5 (d, C-1'), 70.1 (t, C-6), 75.8 (d, C-2), 123.8 / 124.4 (2s, C-4,-5). – MS (EI):  $m/z$  (%) = 41 (45) [C<sub>3</sub>H<sub>5</sub><sup>+</sup>], 55 (54) [C<sub>4</sub>H<sub>7</sub><sup>+</sup>], 67 (66) [C<sub>5</sub>H<sub>9</sub><sup>+</sup>], 83 (100) [C<sub>6</sub>H<sub>11</sub><sup>+</sup>], 111 (65) [M<sup>+</sup>-C<sub>5</sub>H<sub>11</sub>], 182 (28) [M<sup>+</sup>].

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**2-Butyl-4,5-dimethyl-3,6-dihydro-2H-pyran (Compound 4):**

2-Nitropropane (1.8 ml, 20 mmol) was added at 0 °C to a stirred suspension of aluminium trichloride (2.67 g, 20 mmol) in dichloromethane (80 ml). Pentanal  
10 (17.2 g, 200 mmol) was added at -78 °C, followed by 2,3-dimethyl-1,3-butadiene (24.6 g, 300 mmol). The cooling bath was removed and the reaction was stirred at room temperature for 3h. The mixture was then poured into water (400 ml), and the product extracted with pentane (3x 400 ml). The organic extracts were combined and dried, the solvent was evaporated in vacuo, and the resulting  
15 residue purified by distillation to furnish at 34–38 °C / 0.05 mbar the title compound 4 (7.87 g, 12%).

Odor: green, spicy, rose oxide, hyacinth. – IR (neat):  $\nu = 1100$  cm<sup>-1</sup> ( $\nu$  C–O–C), 1387 ( $\delta$  CH<sub>3</sub>), 1450 ( $\delta$  CH<sub>2</sub>). – <sup>1</sup>H-NMR (CDCl<sub>3</sub>):  $\delta = 0.91$  (t,  $J = 7.0$  Hz, 3H, 5'-H<sub>3</sub>), 1.30–1.58  
20 (m, 6H, 1'-H<sub>2</sub>–3'-H<sub>2</sub>), 1.53 / 1.63 (2s, 6H, 4,-5-Me), 1.80 (d,  $J = 16.0$  Hz, 1H, 3-H<sub>b</sub>), 1.94 (br. t,  $J = 16.0$  Hz, 1H, 3-H<sub>a</sub>), 3.45 (m, 1H, 2-H), 3.93 / 4.01 (2d,  $J = 15.5$  Hz, 2H, 6-H<sub>2</sub>). – <sup>13</sup>C-NMR (CDCl<sub>3</sub>):  $\delta = 13.8$  (q, 5-Me), 14.0 (q, C-4'), 18.3 (q, 4-Me), 22.7 (t, C-3'), 27.7 (t, C-2'), 35.6 / 36.7 (t, C-3,-1'), 69.8 (t, C-6), 74.2 (d, C-2), 123.5 / 124.3 (2s, C-4,-5). – MS (EI):  $m/z$  (%) = 41 (36) [C<sub>3</sub>H<sub>5</sub><sup>+</sup>], 55 (41) [C<sub>4</sub>H<sub>7</sub><sup>+</sup>], 67 (79) [C<sub>5</sub>H<sub>9</sub><sup>+</sup>], 82 (100) [C<sub>6</sub>H<sub>10</sub><sup>+</sup>],  
25 85 (58) [C<sub>5</sub>H<sub>9</sub>O<sup>+</sup>], 111 (20) [M<sup>+</sup>-C<sub>4</sub>H<sub>9</sub>], 153 (16) [M<sup>+</sup>-CH<sub>3</sub>], 168 (54) [M<sup>+</sup>].

**4,5-Dimethyl-2-pentyl-3,6-dihydro-2H-pyran (Compound 5):**

2-Nitropropane (1.8 ml, 20 mmol) was added at -10 °C to a stirred suspension of  
30 aluminium trichloride (2.67 g, 20 mmol) in dichloromethane (80 ml). At this temperature, a solution of hexanal (20.0 g, 200 mmol) in dichloromethane (80 ml) was added within 15 min, followed by dropwise addition of 2,3-dimethyl-1,3-

butadiene (24.6 g, 300 mmol) in a period of another 15 min. After further stirring at 0 °C for 90 min, the cooling bath was removed, and another portion of 2,3-dimethyl-1,3-butadiene (24.6 g, 300 mmol) was added dropwise with stirring at room. Stirring was continued at ambient temperature for 14 h, prior to pouring  
5 the reaction mixture into water (400 ml) and extraction of the product with MTBE (3x 400 ml). The combined organic extracts were dried, the solvent was removed under reduced pressure, and the resulting residue purified by distillation in vacuo to provide at 53–58 °C / 0.30–0.35 mbar the title compound 5 (5.41 g, 15%).

10 Odor: Strong, green peas, vegetable, isohexyl methoxy pyrazine, lily and hyacinth.  
– IR (neat):  $\nu = 1102 \text{ cm}^{-1}$  ( $\nu \text{ C-O-C}$ ), 1386 ( $\delta \text{ CH}_3$ ), 1449 ( $\delta \text{ CH}_2$ ), 1691 ( $\nu \text{ C=C}$ ). –  $^1\text{H-NMR}$  ( $\text{CDCl}_3$ ):  $\delta = 0.89$  (t,  $J = 7.0 \text{ Hz}$ , 3H, 5'-H<sub>3</sub>), 1.27–1.69 (m, 8H, 1'-H<sub>2</sub>–4'-H<sub>2</sub>), 1.53 / 1.59 (2s, 6H, 4-,5-Me), 1.80 (d,  $J = 16.0 \text{ Hz}$ , 1H, 3-H<sub>b</sub>), 1.94 (br. t,  $J = 16.0 \text{ Hz}$ , 1H, 3-H<sub>a</sub>), 3.45 (m, 1H, 2-H), 3.93 / 4.01 (2d,  $J = 15.5 \text{ Hz}$ , 2H, 6-H<sub>2</sub>). –  $^{13}\text{C-NMR}$  ( $\text{CDCl}_3$ ):  $\delta = 13.8$   
15 (q, 5-Me), 14.0 (q, C-5'), 18.3 (q, 4-Me), 22.6 (t, C-4'), 25.1 (t, C-2'), 31.9 (t, C-3'), 35.8 / 36.7 (t, C-3,-1'), 69.8 (t, C-6), 74.2 (d, C-2), 123.5 / 124.3 (2s, C-4,-5). – MS (EI):  $m/z$  (%) = 41 (32) [ $\text{C}_3\text{H}_5^+$ ], 55 (38) [ $\text{C}_4\text{H}_7^+$ ], 67 (64) [ $\text{C}_5\text{H}_9^+$ ], 82 (100) [ $\text{C}_6\text{H}_{10}^+$ ], 111 (20) [ $\text{M}^+ - \text{C}_5\text{H}_{11}$ ], 167 (11) [ $\text{M}^+ - \text{CH}_3$ ], 182 (37) [ $\text{M}^+$ ].

20 2-Hexyl-4,5-dimethyl-3,6-dihydro-2H-pyran (Compound 6):

2-Nitropropane (1.8 ml, 20 mmol) was added at –10 °C to a stirred suspension of aluminium trichloride (2.67 g, 20 mmol) in dichloromethane (80 ml). Heptanal (22.8 g, 200 mmol) was added dropwise at this temperature during 15 min,  
25 followed by dropwise addition of 2,3-dimethyl-1,3-butadiene (24.6 g, 300 mmol) during 20 min. The reaction was stirred –10°C for 15 min., and at room temperature for 1h. Another portion of 2,3-dimethyl-1,3-butadiene (24.6 g, 300 mmol) was added during 20 min, and stirring was continued at room temperature for 15 h. The mixture was then poured into water (300 ml), and the product  
30 extracted with MTBE (3x 300 ml). The organic extracts were combined and dried, the solvent was evaporated in vacuo, and the resulting residue purified by FC (pentane/ether, 100:1) on silica gel to provide the title compound 6 (2.78 g, 7%).



Odor: Strong, green peas, parsley, vegetable, pyrazine, roots. – IR (neat):  $\nu = 1104$   $\text{cm}^{-1}$  ( $\nu$  C–O–C), 1456 ( $\delta$  CH<sub>2</sub>), 1386 ( $\delta$  CH<sub>3</sub>), 1693 ( $\nu$  C=C). – <sup>1</sup>H-NMR (CDCl<sub>3</sub>):  $\delta = 0.88$  (t,  $J = 7.0$  Hz, 3H, 6'-H<sub>3</sub>), 1.29–1.69 (m, 10H, 1'-H<sub>2</sub>–5'-H<sub>2</sub>), 1.53 / 1.63 (2s, 6H, 4-,5-Me),  
 5 1.80 (d,  $J = 16.0$  Hz, 1H, 3-H<sub>b</sub>), 1.94 (br. t,  $J = 16.0$  Hz, 1H, 3-H<sub>a</sub>), 3.45 (m<sub>c</sub>, 1H, 2-H),  
 3.93 / 4.01 (2d,  $J = 16.0$  Hz, 2H, 6-H<sub>2</sub>). – <sup>13</sup>C-NMR (CDCl<sub>3</sub>):  $\delta = 13.8$  (q, 5-Me), 14.1 (q, C-6'), 18.3 (q, 4-Me), 22.6 (t, C-5'), 25.4 (t, C-2'), 29.4 (t, C-3'), 31.8 (t, C-4'), 35.9 / 36.7 (t, C-3,-1'), 69.8 (t, C-6), 74.3 (d, C-2), 123.5 / 124.3 (2s, C-4,-5). – MS (EI):  $m/z$  (%) = 41  
 (24) [C<sub>3</sub>H<sub>5</sub><sup>+</sup>], 55 (29) [C<sub>4</sub>H<sub>7</sub><sup>+</sup>], 67 (51) [C<sub>5</sub>H<sub>7</sub><sup>+</sup>], 82 (100) [C<sub>6</sub>H<sub>10</sub><sup>+</sup>], 85 (52) [C<sub>6</sub>H<sub>13</sub><sup>+</sup>], 111  
 10 (21) [M<sup>+</sup>–C<sub>6</sub>H<sub>13</sub>], 181 (13) [M<sup>+</sup>–CH<sub>3</sub>], 196 (37) [M<sup>+</sup>].

**4,5-Dimethyl-2-(1-methylpropyl)-3,6-dihydro-2H-pyran (Compound 9):**

To a suspension of aluminium trichloride (2.67 g, 20 mmol) in dichloromethane  
 15 (50 ml) was added 2-nitropropane (1.8 ml, 20 mmol) at 0 °C. At the same temperature, a solution of 2-methylbutanal (17.2 g, 200 mmol) and 2,3-dimethylbutadiene (24.6 g, 300 mmol) in dichloromethane (30 ml) was added dropwise with stirring, and stirring was continued at 0 °C for 30 min. and at room temperature for 2 h, prior to the addition of another portion of 2,3-dimethylbutadiene (24.6 g, 300 mmol). After further stirring at room temperature  
 20 for 15 h, the reaction mixture was poured into water (300 ml) and the product was extracted with MTBE (3x 300 ml). The combined organic extracts were dried and concentrated under reduced pressure. The resulting crude product was purified by distillation to provide at 90–92 °C / 20 mbar the title compound 9 (5.76 g, 17%).

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Odor: Rose oxide, green, aromatic. – IR (neat):  $\nu = 1099$   $\text{cm}^{-1}$  ( $\nu$  C–O–C), 1383 ( $\delta$  CH<sub>3</sub>), 1457 ( $\delta$  CH<sub>2</sub>). – <sup>1</sup>H-NMR (CDCl<sub>3</sub>):  $\delta = 0.91$  / 0.97 (2d,  $J = 7.0$  Hz, 3H, 1'-Me), 0.92 / 0.93 (2t,  $J = 7.0$  Hz, 3H, 4'-H<sub>3</sub>), 1.15–1.64 (m, 3H, 1'-H<sub>2</sub>,2'-H<sub>2</sub>), 1.56 / 1.67 (2s, 6H, 4-,5-Me), 1.77 (2 br. d,  $J = 16.0$  Hz, 1H, 3-H<sub>b</sub>), 2.05 / 2.08 (2 br. t,  $J = 16.0$  Hz, 1H, 3-H<sub>a</sub>), 3.30 (m<sub>c</sub>,  
 30 1H, 2-H), 3.97 / 4.03 (2d,  $J = 15.5$  Hz, 2H, 6-H<sub>2</sub>). – <sup>13</sup>C-NMR (CDCl<sub>3</sub>):  $\delta = 11.3$  / 11.5 (q, C-3'), 13.7 / 13.8 / 14.2 / 14.6 (4q, 5-Me, C-4'), 18.4 / 18.5 (2q, 4-Me), 25.0 / 25.4 (2t, C-2'), 33.1 / 33.7 (2t, C-3), 39.2 / 39.3 (2d, C-1'), 70.1 / 70.2 (2t, C-6), 77.9 / 77.9 (2d, C-

2), 123.7 / 123.8 / 124.4 / 124.4 (4s, C-4,-5). – MS (EI):  $m/z$  (%) = 41 (44) [ $C_3H_5^+$ ], 55 (59) [ $C_4H_7^+$ ], 67 (75) [ $C_5H_9^+$ ], 83 (100) [ $C_6H_{11}^+$ ], 111 (58) [ $M^+ - C_4H_9$ ], 153 (2) [ $M^+ - CH_3$ ], 168 (45) [ $M^+$ ].

5 4,5-Dimethyl-2-(1-methylbutyl)-3,6-dihydro-2H-pyran (Compound 10):

2-Nitropropane (1.8 ml, 20 mmol) was added at  $-10^\circ\text{C}$  to a stirred suspension of aluminium trichloride (2.67 g, 20 mmol) in dichloromethane (80 ml). At this temperature, 2-methylpentanal (20.0 g, 200 mmol) was added dropwise during 20 min, followed by 2,3-dimethyl-1,3-butadiene (24.6 g, 300 mmol) during 30 min. After further stirring at this temperature for 30 min, and for 1h at ambient temperature, the reaction mixture was poured into water (300 ml) and the product extracted with MTBE (3x 300 ml). The combined organic extracts were dried, concentrated in vacuo, and purified by silica-gel FC (pentane/MTBE, 100:1, 15  $R_f$  = 0.21) to provide the title compound 10 (7.43 g, 20%).

Odor: Green, vegetable, aromatic, tea-like. – IR (neat):  $\nu$  = 1101  $\text{cm}^{-1}$  ( $\nu$  C–O–C), 1383 ( $\delta$   $CH_3$ ), 1456 ( $\delta$   $CH_2$ ). –  $^1\text{H-NMR}$  ( $CDCl_3$ ):  $\delta$  = 0.88 / 0.94 (2d,  $J$  = 7.0 Hz, 3H, 1'-Me), 0.89 / 0.90 (2t,  $J$  = 7.0 Hz, 3H, 4'-H<sub>3</sub>), 1.10–1.61 (m, 5H, 1'-H, 2'-,3'-H<sub>2</sub>'), 1.52 / 20 1.64 (2s, 6H, 4-,5-Me), 1.73 (br. d,  $J$  = 16.5 Hz, 1H, 3-H<sub>b</sub>), 2.05 (m, 1H, 3-H<sub>a</sub>), 3.26 (m, 1H, 2-H), 3.94 / 4.00 (2 br. d,  $J$  = 15.5 Hz, 2H, 6-H<sub>2</sub>). –  $^{13}\text{C-NMR}$  ( $CDCl_3$ ):  $\delta$  = 13.8 / 14.3 / 14.7 / 15.1 (4q, 5-Me, C-4'), 18.3 / 18.4 (2q, 4-Me), 20.1 / 20.2 (2t, C-2'), 33.0 / 33.6 (2t, C-3'), 34.6 / 35.0 (2t, C-3), 37.3 / 37.5 (2d, C-1'), 70.1 / 70.2 (2t, C-6), 78.1 / 78.2 (2d, C-2), 123.6 / 123.7 / 124.4 / 124.4 (4s, C-4,-5). – MS (EI):  $m/z$  (%) = 43 (44) [ $C_3H_7^+$ ], 25 55 (55) [ $C_4H_9^+$ ], 67 (67) [ $C_5H_9^+$ ], 83 (100) [ $C_6H_{11}^+$ ], 111 (63) [ $M^+ - C_5H_{11}$ ], 167 (2) [ $M^+ - CH_3$ ], 182 (30) [ $M^+$ ].

Floral-green perfume oil for fabric softeners:

	compound/ingredient	parts by weight 1/1150
	1. Agrumex ( <i>ortho-tert</i> -Butylcyclohexyl acetate)	5
	2. Aubepine ( <i>para</i> -Methoxybenzaldehyde) / <i>para</i> -cresol	15
5	3. Benzyl acetate	25
	4. Benzyl salicylate	35
	5. <i>para-tert</i> -Butylcyclohexyl acetate	106
	6. Butyl hydroxy toluene	2
	7. Cinnamic alcohol	5
10	8. Citronellol, extra quality	50
	9. Coumarine, pure, crystalline	10
	10. Damasconone @ 1% in DPG	10
	11. <i>alpha</i> -Damascone @ 10% in DPG	4
	12. <i>gamma</i> -Decalactone	4
15	13. Decanal	4
	14. Dihydromyrcenol	40
	15. DPG (Dipropylene glycol)	20
	16. Ebanol (3-Methyl-5-(2,2,3-trimethyl-3-cyclopenten-1-yl)-4-penten-2-ol)	3
20	17. Ethyl vanillin	3
	18. Eugenol, pure @ 10% in DPG	10
	19. Fixolide (6-Acetyl-1,1,2,4,4,7-hexamethyltetralin)	10
	20. Galaxolide 50 PHT (4,6,6,7,8,8-Hexamethyl-1,3,4,6,7,8-hexahydrocyclopenta[g]benzopyran)	100
25	21. Gardenol (1-Phenylethyl acetate)	15
	22. Geraniol	40
	23. <i>alpha</i> -Hexylcinnamaldehyde	90
	24. 6-/8-Isobutylquinoline @ 10% in DPG	5
	25. Isoraldeine 70 (8-Methylionone)	50
30	26. Lilial (2-Methyl-3-(4- <i>tert</i> -butylphenyl)propanal)	80
	27. Linalool	80
	28. Manzanate (Ethyl 2-methyl pentanoate) @ 10% in DPG	5
	29. Mayol ( <i>para</i> -Isopropylcyclohexylmethanol)	2

	30.	Menthone @ 10% in DPG	5
	31.	2-Methyldecanal @ 10% in DPG	3
	32.	6-Methylhept-5-en-2-one @ 10% in DPG	10
	33.	Methyl isoeugenol	5
5	34.	Methyl salicylate @ 10% in DPG	5
	35.	Nerol, extra quality	10
	36.	Okoumal (2,4-Dimethyl-2-(1,1,4,4-tetramethyl-tetralin-6-yl)-1,3-dioxolane)	15
	37.	2-Phenylethanol	25
10	38.	Strawberry pure (Ethyl 3-methyl-3-phenyl-glycidate) @ 10% in DPG	10
	39.	Terpenyl acetate	40
	40.	Terpineol, pure	70
	41.	<i>gamma</i> -Undecalactone	4
15	42.	Undecanal	40
	43.	10-Undecenal @ 10% in DPG	20
	44.	Verdyl acetate	30
	45.	Veloutone (2,2,5-Trimethyl-5-pentylcyclopentanone) @ 10% in DPG	10
20	46.	Ylang ylang oil	15
	47.	Compound 5 @ 10% in DPG	5

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**1150**

- 25 Compound 5 conveys to this perfume freshness and lift, and in particular petigrain-type aspects. It combines very well with the aldehydes, and turns the top note of the fragrance oil more eau de cologne-like; thereby, 5 attenuates the functional aspects of the fragrance and the fabric softener becomes overall more sophisticated, more refined.

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**Floral-marine fragrance for soap:**

	compound/ingredient	parts by weight 1/820
	1. Agrumex (2- <i>tert</i> -Butylcyclohexyl acetate)	30
5	2. Ambrofix (3-Methyldodechydro-6,6-9a-oxidotetranorlabdane) @ 10% in DEP	2
	3. Aubepine ( <i>para</i> -Methoxybenzaldehyde) / <i>para</i> -cresol @ 10% in DPG	2
	4. Bergamot Givco 104	80
	5. <i>iso</i> -Butyl benzoate	30
10	6. Cassis Base 345-F CS	2
	7. Cetone V (1-(2,6,6-Trimethyl-2-cyclohexen-1-yl)-hepta-1,6-dien-3-one)	2
	8. Citral	5
	9. Citron Ess Reconst 1385	10
15	10. Citronellyl nitrile	1
	11. <i>beta</i> -Damascone @ 1% in DPG	20
	12. 2,4-Dimethyl-3-cyclohexenecarboxaldehyde	4
	13. DPG (Dipropylene glycol)	83
20	14. Floralozone ( <i>alpha, alpha</i> -Dimethyl-4-ethylbenzenepropanal)	5
	15. Galaxolide 50 PHT (4,6,6,7,8,8-Hexamethyl-1,3,4,6,7,8-hexahydrocyclopenta[g]benzopyran)	30
	16. Geraniol, extra quality	5
	17. Hedione	100
25	18. <i>cis</i> -3-Hexenol @ 10% in DPG	5
	19. <i>cis</i> -3-Hexenyl acetate @ 10% in DPG	5
	20. <i>cis</i> -3-Hexenyl butyrate @ 10% in DPG	5
	21. <i>cis</i> -3-Hexenyl hexenoate @ 10% in triethyl citrate	10
	22. <i>alpha</i> -Hexylcinnamaldehyde	100
30	23. <i>beta</i> -Ionone	15
	24. <i>cis</i> -Jasmone	2
	25. Linalool	50
	26. Mandarin Base (Firmenich)	3

	27.	Methyl 2-nonynoate @ 1% in DPG	5
	28.	Nerolidol	100
	29.	Neroli oil	2
	30.	Nutmeg (mace) oil @ 10 % in DPG	2
5	31.	Phenylethyl phenylacetate	3
	32.	Terpenyl Acetate	50
	33.	Terpineol, pure	20
	34.	Terpinolene	10
	35.	<i>gamma</i> -Undecalactone	2
10	36.	Compound 5 @ 10% in DPG	20

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**820**

Compound 5 harmoniously combines the hesperidic, floral-marine and green notes of the fragrance; thereby, it rounds off the composition and increases its radiance. In addition, it introduces naturalness and increases the character of that fragrance. At this relatively high dosage, 5 additionally brings in facets of petitgrain oil and jasmone; overall, 5 conveys to the fragrance its unique texture, its fresh and hygienic but also soft and caressing character.

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**Essai for a male fine fragrance:**

	compound/ingredient	parts by weight 1/1000
25	1. Ambrein, pure Base (Biolande)	2
	2. Anise oil	2
	3. Artemisia (Armoise) oil	3
	4. Bergamotte Givco 104	80
	5. Benzyl salicylate	50
30	6. Birch Leaf Givco 166	4
	7. Bornyl acetate	5
	8. Coumarine, pure	5
	9. Cyclal C (2,4-Dimethyl-3-cyclohexene carboxaldehyde)	1

	10.	<i>delta</i> -Damascone	1
	11.	Dihydromyrcenol	120
	12.	DPG (Dipropylene glycol)	95
	13.	Evernyl (Methyl 3,6-dimethylresorcylate)	8
5	14.	Fir balsam resinoide	2
	15.	Galaxolide 50 PHT (4,6,6,7,8,8-Hexamethyl- 1,3,4,6,7,8-hexahydrocyclopenta[g]benzopyran)	180
	16.	Galbanone 10 (1-(5,5-Dimethyl-1-cyclohexen-1-yl)- 4-penten-1-one)	5
10	16.	Gardenol (1-Phenylethyl acetate)	2
	17.	Geranium oil	8
	18.	Hedione	150
	19.	Iso E Super	160
	20.	Kephalis (4-(1-Ethoxyethenyl)-3,3,5,5-tetra- methylcyclohexanone)	15
15	21.	Lavandin Grosso oil	3
	22.	Linalool	40
	23.	Melonal (2,6-Dimethylhept-5-enal) @ 10% in DPG	1
	24.	Nutmeg (mace) oil	5
20	25.	Patchouli oil (iron free)	8
	26.	Radjanol	40
	36.	Compound 5	5

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**1000**

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Compound 5 conveys to this male fine fragrance essai its fresh facet: a green and invigorating botanical freshness, clean, clear and compelling. It enriches the classical top of this modern fougere by new aspects, increases radiance and diffusion, and harmonises and stages the spicy accord of anise, artemisia and nutmeg oils. In result, this masculine scent acquires a herbal crispness that does not disturb the mysterious sensuality of the woody-musky-mossy-coumarine fond, but instead accentuates it.

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